Corrales Environmental Health Evaluation Community Process Summary Report

Prepared by
The New Mexico Environment Department (NMED)

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Executive Summary

Beginning with a request from the mayor of Corrales received in October 2001, the New Mexico Environment Department (NMED) has conducted a health risk assessment project for the Village of Corrales. This project was conducted in accordance with U.S. Environmental Protection Agency (USEPA) guidelines for health risk assessments. The mission of the project was to work cooperatively with the local and county governments, citizens of Corrales, area industrial complexes and the New Mexico Department of Health (DOH) to identify and analyze potential air quality health risks due to toxic air pollution in the Village of Corrales.

The NMED Air Quality Bureau (AQB) proposed a stakeholder-based health risk assessment process to develop a plan to research, identify and quantify potential air quality health risks from toxic air pollutants in the Village of Corrales. The process entailed a series of facilitated public meetings and forums to provide community input for the direction and focus of the work plan. The project involved:

- initial air quality monitoring to help focus the scope of the inventory, identifying potential hot spots and specific air toxics of concern,
- the development of an emissions inventory including air toxics emissions for the area,
- a modeling analysis,
- a refined monitoring study to estimate exposure levels,
- and a toxicological risk characterization considering the monitored and modeled results and dose-response assessment.

Initial air quality monitoring was performed at several locations within Corrales in compliance with USEPA monitoring methods in December 2002 and January 2003. Monitoring was conducted during 24-hour periods to identify air toxics of concern and hotspots within the area. An emissions inventory was conducted to quantify toxic air pollutant emissions in the area and determine source-specific parameters for these emissions. The inventory was specifically developed for use in the air dispersion modeling analysis. A refined monitoring study was conducted during the summer of 2003 using various USEPA monitoring methods, including the Open Path-Fourier Transform Infra-Red (OP-FTIR). This monitoring data was collected for use in the health risk assessment. A modeling analysis was conducted using meteorological model data and the emissions inventory data completed earlier. The results of all monitoring studies and the modeling study were used to determine health risk due to specific toxic air pollution within the Corrales study area.

From April 2003 to May 2004, NMED collected information regarding health and odor complaints from residents of Corrales, Rio Rancho and Albuquerque. A total of 266 reports were received during this period (see Table 3). Two individuals submitted 54% of the total reports. Five individuals submitted 79% of the total reports. Odor and health complaints are difficult to assess. Individuals may have different odor perceptions and symptom thresholds. Several different odor descriptors have been reported in the study

area. Health symptoms reported are somewhat diverse, but include burning and watering eyes and sinuses. In some cases, only odors are reported and no health symptoms were reported.

NMED conducted one of the most comprehensive studies of air toxics related health effects ever to be completed for any community in the state. The study began in 2002 and a total of approximately $230,000 was expended including $141,00 in EPA grants and $89,000 in Department funds.

By comparing all available data from the Corrales study to U.S. EPA Urban Air Toxics data, this information can be put in context. Using this approach, Corrales air quality appears to be equivalent to or better than that found in other large metropolitan areas. Corrales is a small community with a rural nature, but is proximal to a large metropolitan area. Due to the terrain and the diurnal flow of air up and down the river valley, Corrales becomes part of the Albuquerque air shed.

In conclusion, based upon available data, this health risk assessment did not find evidence that any of the modeled or measured chemicals are associated with increased acute or chronic health risks. It must be noted, however, that uncertainties associated with the limited nature of available monitoring and modeling data do exist.

Acronyms & Abbreviations

AQB	Air Quality Bureau
DOH	Department of Health
DRI	Desert Research Institute
EPA	Environmental Protection Agency
ESL	Effect Screening Level (threshold levels defined by TNRCC – TARA)
OP-FTIR	Open-Path Fourier Transform Infrared Spectrometer
GCMS	Gas Chromatograph / Mass Spectrometer
HAP	Hazardous Air Pollutant
HI	Hazard Index (the cumulative risk associated with a scenario involving multiple chemicals: the sum of individual HQs within the scenario)
HQ	Hazard Quotient (the risk factor associated with a single chemical)
IO3.5	Method for analyzing carbonyl compounds in air samples
IPA	Isopropyl Alcohol (also called 2-Propanol)
Max	Maximum
MDL	Method Detection Limit
Min	Minimum
NMED	New Mexico Environment Department
OP-FTIR	Open Path-Fourier Transform Infra-Red
PHA	Public Health Assessment
PM	Planned Maintenance
PPB	Parts Per Billion
Rd	Road
RTO	Regenerative Thermal Oxidizer

SLD	State Laboratory Division
St	Street
TAP	Toxic Air Pollutant (according to the State of New Mexico)
TARA	Toxicology & Risk Assessment (Section of TNRCC])
TIC	Tentatively Identified Compound
TNRCC	Texas Natural Resources Conservation Commission
TO	Thermal Oxidizer
TO15	Toxic Organic method-15 (EPA approved method, GCMS)
TO16	Toxic Organic method-15 (EPA approved method, FTIR)
TP15	Toxic Particulate method 15 (EPA approved method for particulate analysis)
US	United States
UTM	Universal Transverse Mercatur (a coordinate system used in mapping)
VOC	Volatile Organic Compound

Introduction

Toxic air pollutants are substances in the air that are harmful to the environment or to the public. They may come from natural sources or industrial facilities. Inhaling toxic air pollutants may increase the risk of public health problems, such as cancer, respiratory and nervous system problems, and birth defects. For example, inhaling the benzene fumes that are emitted while pumping gas into an automobile can increase an individual's chances of experiencing health effects that have been associated with exposure to benzene, such as leukemia. Some health effects of toxic air pollution occur immediately, such as coughing. Other health effects, such as cancer, may be delayed.

Health risks are a measure of the chance that an individual will experience health problems. Some air toxics may increase the risk of cancer; while other air toxics may increase the risk of developing other health problems, such as emphysema or reproductive disorders. In this study, concentrations of toxic air pollution in the Corrales area were examined.

Risk assessment is the process used by scientists and recommended by the USEPA to estimate the increased health risks to those exposed to toxic substances. The risk assessment for toxic air pollution in Corrales combined results of studies to estimate the level of exposure to various air toxics with results of studies of the health effects of exposures to each air toxic identified in the study area. In some cases, a health risk assessment has led to the identification of air pollution control measures that should be taken to reduce exposure to toxic air pollution and reduce health risks.

The Health Risk Assessment Process

A health risk assessment is comprised of four components, per the USEPA:

1. Hazard Identification
2. Exposure Assessment
3. Dose Response Assessment
4. Risk Characterization

Hazard Identification is the first component of a risk assessment. This involves determining the prevalent air toxics within the study area and the sources of these air toxics. NMED accomplished the hazard identification step through preliminary air monitoring to determine what air toxics are present in Corrales. An emissions inventory was completed to determine the known sources of air toxics within the area.

The second step in a risk assessment is Exposure Assessment. This step is accomplished by determining the maximum concentrations of toxic air pollution and the locations of these maximum concentrations. NMED fulfilled the exposure assessment through the completion of a modeling analysis based on the emissions inventory. Additionally, the

refined monitoring analysis also identified maximum concentrations for specific locations within the study area.

The Dose Response Assessment and Risk Characterization identifies the public health problems that are associated with the concentrations of air toxics that are measured or modeled within the study area and the health risk to the public residing or visiting the study area. This portion of the analysis relies upon health studies that have been conducted for specific air toxics to identify thresholds or risks of various diseases or illnesses. The Dose Response Assessment and the Risk Characterization were completed in the health risk characterization report.

Project Activities

Figure 1 shows the project activities. The timeline begins 2001 in order to show the source of data that was used during modeling. Long bars represent tasks. Light green bars represent contractor tasks while all other tasks are blue. Black diamonds represent one-day events. Reports are shown as red milestones. Lines indicate data from one activity or report flowing into another activity or report.

Monitoring Data

Table 1 summarizes the monitoring data that was evaluated by NMED in support of the health risk assessment. A brief summary of each data set is provided below. Discussion will refer to the data sets by the number in the first column.

Table 1 Summary of Monitoring Data

#	Sample Set	Start Date	End Date	Samples	Analytical Method
1	Urban Toxics, Rio Rancho	Jul. 24, 01	Jul. 31, 02	46 Samples	TO15, TP11, IO3.5
2	Urban Toxics, Bernalillo	Jul. 24, 01	Jul. 31, 02	32 Samples	TO15, TP11, IO3.5
3	Prism/Intel Ambient Air Sampling	Sep. 27, 02	Mar. 20, 03	28 Samples	As-002-Hs, TO15, FTIR-TO16
4	Urban Toxics, Albuquerque	Jan. 3, 03	Nov. 27, 03	12 Samples	TO15, TP11, IO3.5
5	NMED 24-Hr Samples	Dec 26, 02	Jan. 13, 03	8 Samples	TO15, TP11, IO3.5
6	Citizens Grab Samples	Jun. 26, 03	Aug. 9, 03	9 Samples	TO15
7	NMED 1-Hr Canisters	Aug. 6, 03	Aug. 30, 03	5 Samples	TO15
8	Arcadis/NMED FTIR	Jul. 29, 03	Sep. 2, 03	36 days	TO16, FTIR
9	TRC/Intel FTIR	Aug. 1, 03	Sep. 5, 03	36 days	TO16, FTIR
10	Intel Stack, RTO shutdown	Aug. 11, 03	Aug. 11, 03	1 day	TO16, FTIR

Silonite Canisters: 140 samples, 18 locations
Two FTIRs took data for 36 days at three locations

Sampling and Analytical Methods for Ambient Monitoring of Air Toxics: Silonite Canisters and Open Path-Fourier Transform Infra-Red (OP-FTIR)

Analysis of air toxics within the study area was completed using two methods, Canister sampling and the OP-FTIR. Air samples were collected in Silonite Canisters over a given period of time through the intake of air surrounding the canister and subsequent

analysis of the sample at New Mexico Department of Health Scientific Laboratory Division (DOH/SLD). The OP-FTIR projects a beam across a path that is reflected back to the instrument and instantaneously analyzed to determine toxics that are present within the path.

Each method is able to detect some chemicals that the other cannot find. Minimum detection levels (MDLs) are substance-specific for both methods.

Based on side-by side measurements, canisters appear, in general, to detect lower concentrations of air toxics than the OP-FTIR. The canisters are unable to detect spikes in air pollutant concentrations unless the air intake time period is very short. Additionally, the canisters only provide concentration data for a specific location where the canister is placed; this may or may not be representative of air quality throughout a large study area. A large uncertainty in the OP-FTIR measurements occurs due to the fact that measured concentrations are divided by the path length, based on the assumption that distribution of a toxic air pollutant is uniform throughout the path. In reality, plumes from emissions sources may be highly concentrated in a narrow-width plume. As with the canisters, the OP-FTIR measurements may or may not be representative of air quality throughout a large study area. The OP-FTIR offers minute-by-minute data that is useful in the detection of short-term peaks; however, for the most part, health studies have not been conducted that can evaluate the health impacts of such short-term peaks of toxic air pollution.

Figure 1 Corrales Project Timeline

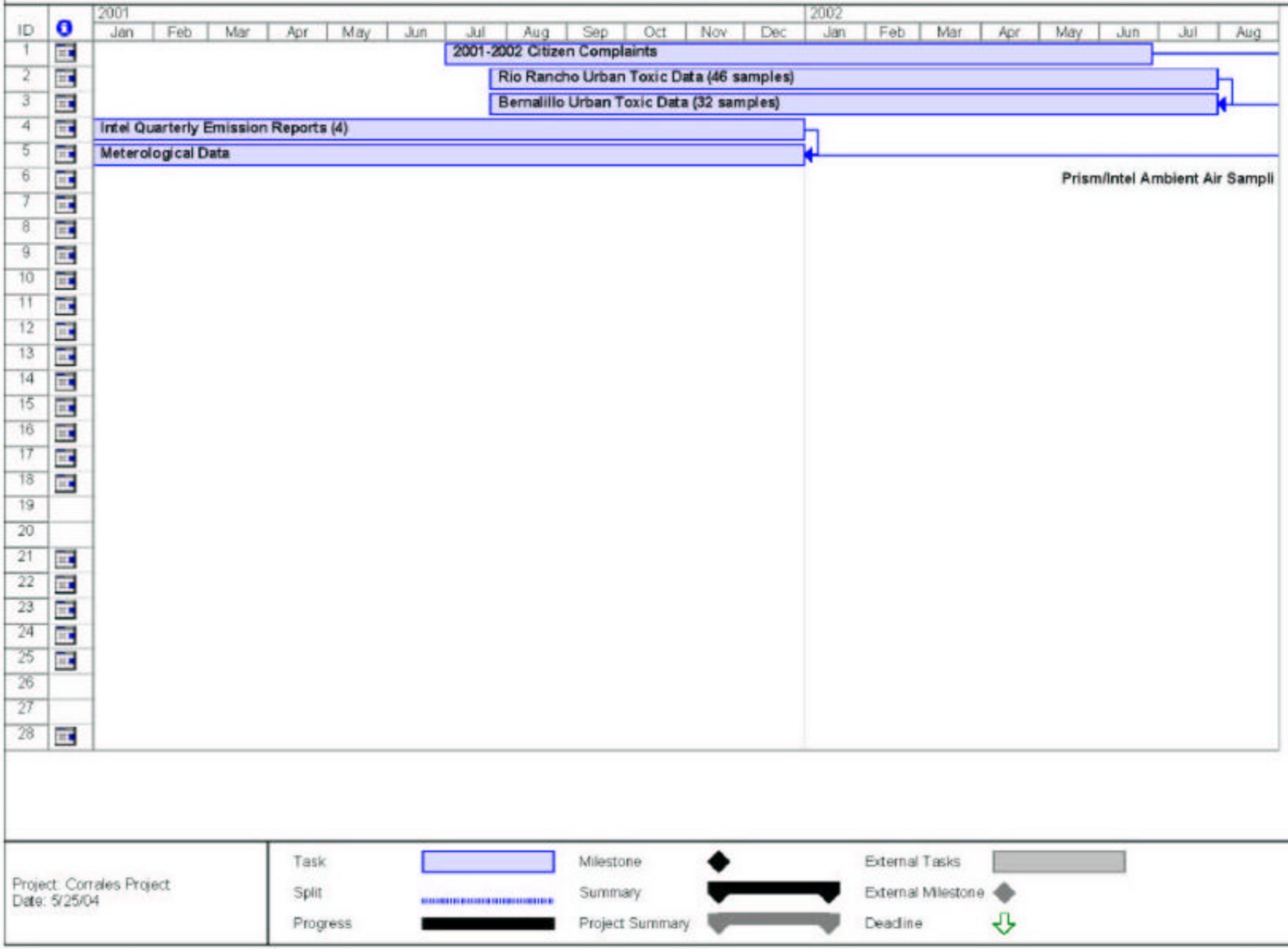
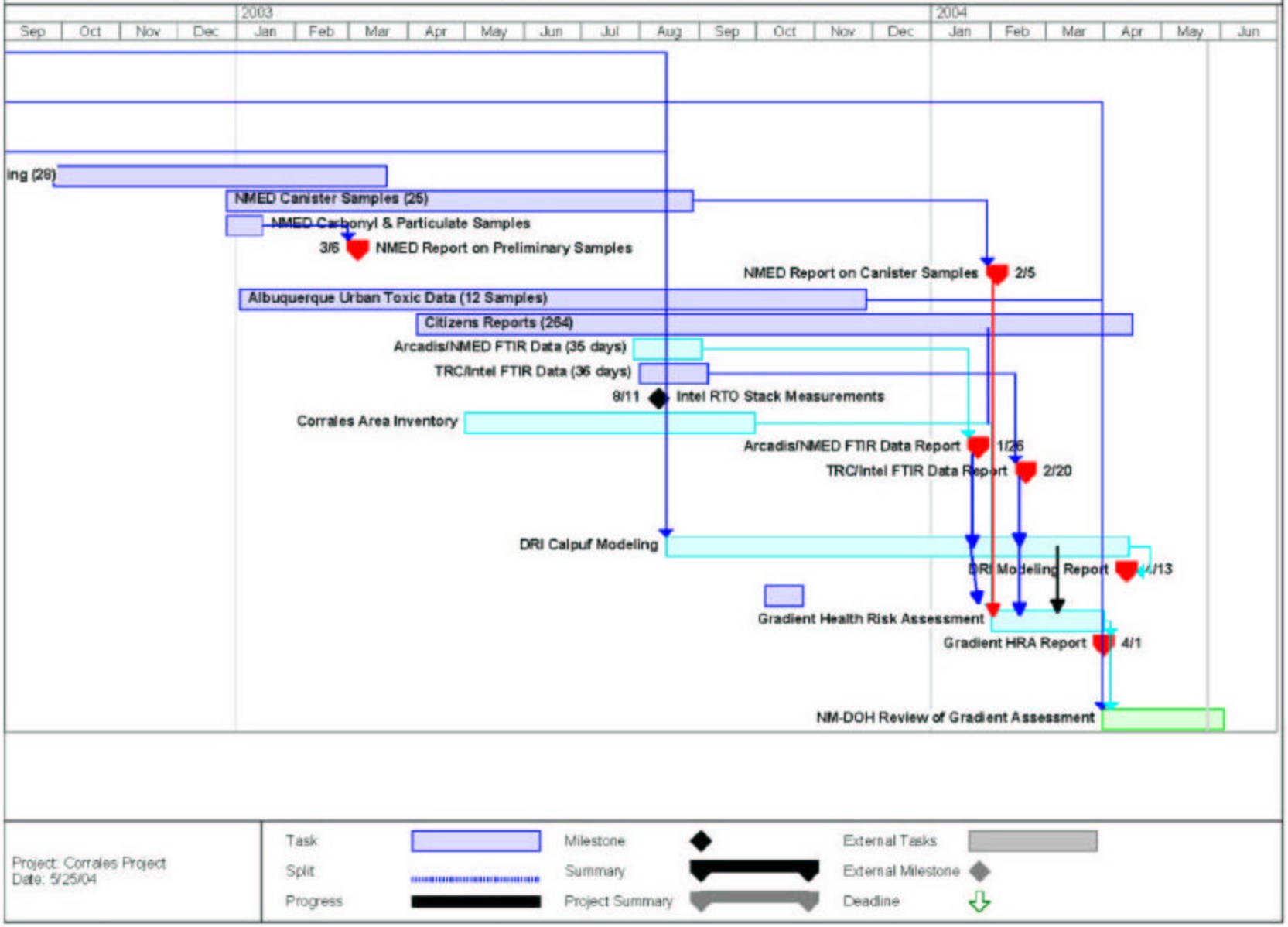


Figure 1 Corrales Project Timeline



Urban Air Toxics Data (sets 1, 2, and 4)

Under the EPA Urban Toxics Program, major U.S. cities and urban areas received USEPA funding to monitor air toxics for a one-year period. NMED monitored at sites in Rio Rancho and Bernalillo between July 2001 and July 2002. Ambient air samples were collected every twelfth day for a one-year period. The City of Albuquerque/Bernalillo County Department of Health and Environment collected similar data at a site near Coors Rd. and Alameda from January 3 to November 27, 2003. This data characterizes the air quality at these monitoring sites.

The Urban Air Toxics program utilized three sampling methods: silonite canisters for the analysis of non-water soluble volatile organic compounds (VOCs), DNPH sorbent cartridges for the analysis of carbonyl compounds, and filter samples for the analysis of airborne particulates. Samples were analyzed at the NMDOH/SLD using the methods shown in the far-right column of Table 1. While USEPA only requested reporting on a limited number of compounds (9), the NMDOH/SLD analyzed and reported on all 41 calibrated analytes.

The Urban Air Toxics data is summarized in Table 2. All values represent 24-hour averages. For each compound in each data set, the number of times detected, the highest, the average, and the minimum 24-hour concentration is shown.

Table 2 Urban Toxic Data:
Rio Rancho, Bernalillo, and Albuquerque

Possible Intel Emission
Data exists but has not been reported
Would have to be obtained and compiled

	Rio Rancho, 46 samples				Bernalillo, 32 samples				City of Albuquerque, 12 samples			
	Taken At:	Rio Rancho Senior Center			Taken At:	City hall			Taken At:	Westside location		
	Dates:	7/24/2001 - 7/31/2002			Dates:	7/24/2001 - 7/31/2002			Dates:	1/6/2003 - 12/24/2003		
		24 Hour Concentration (ppb)				24 Hour Concentration (ppb)				24 Hour Concentration (ppb)		
CAS Number	Chemical Name	Number of Detects	Peak (ppb)	Average (ppb)	Minimum (ppb)	Number of Detects	Peak (ppb)	Average (ppb)	Minimum (ppb)	Number of Detects	Peak (ppb)	Average (ppb)	Minimum (ppb)
107-13-1	Acrylonitrile	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
71-43-2	Benzene	29	0.7	0.3	0.2	32	1.0	0.5	0.2	12	1.1	0.5	0.2
74-83-9	Bromomethane	not detected	u	u	u	3	6.3	2.3	0.3	(not reported by Albuquerque)			
106-99-0	1,3-Butadiene	not detected	u	u	u	not detected	u	u	u	1	0.3	0.3	0.3
56-23-5	Carbon Tetrachloride	not detected	u	u	u	2	0.1	0.1	0.0	1	0.1	0.1	0.1
108-90-7	Chlorobenzene	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
75-00-3	Chloroethane	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
67-66-3	Chloroform	2	0.6	0.3	0.0	not detected	u	u	u	(not reported by Albuquerque)			
74-87-3	Chloromethane	30	0.8	0.6	0.5	31	0.7	0.6	0.0	12	0.6	0.6	0.5
106-93-4	1,2-Dibromomethane (EDB)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
95-50-1	1,2-Dichlorobenzene (o-Dichlorobenzene)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
541-73-1	1,3-Dichlorobenzene (m-Dichlorobenzene)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
106-46-7	1,4-Dichlorobenzene	1	0.1	0.1	0.1	8	0.5	0.3	0.1	1	0.2	0.2	0.2
75-34-3	1,1-Dichloroethane	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
107-06-2	1,2-Dichloroethane	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
75-35-4	1,1-Dichloroethene	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
156-59-2	cis-1,2-Dichloroethene	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
78-87-5	1,2-Dichloropropane	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
1006-10-15	cis-1,3,Dichloropropene	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
1006-10-26	trans-1,3-Dichloropropene	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
100-41-4	Ethylbenzene	3	0.2	0.2	0.1	5	0.3	0.2	0.1	5	0.4	0.2	0.1
75-69-4	Freon 11 (Trichlorofluoromethane)	14	0.4	0.3	0.2	30	8.7	1.5	0.4	(not reported by Albuquerque)			
75-71-8	Freon 12 (Dichlorodifluoromethane)	30	0.7	0.6	0.2	30	1.0	0.6	0.5	(not reported by Albuquerque)			
76-13-1	Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
76-14-2	Freon 114 (Dichlorotetrafluoroethane)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
87-68-3	Hexachloro-1,3-butadiene	not detected	u	u	u	1	1.2	1.2	1.2	(not reported by Albuquerque)			
75-09-2	Dichloromethane (Methylene Chloride)	8	0.5	0.3	0.2	13	0.5	0.3	0.2	10	4.2	1.0	0.3
100-42-5	Styrene	5	0.5	0.3	0.1	not detected	u	u	u	(not reported by Albuquerque)			
79-34-5	1,1,2,2-Tetrachloroethane	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
127-18-4	Tetrachloroethene (Tetrachloroethylene)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
108-88-3	Toluene	31	1.4	0.6	0.2	31	1.7	0.9	0.4	12	2.3	1.1	0.4
120-82-1	1,2,4-Trichlorobenzene	not detected	u	u	u	2	0.2	0.2	0.1	(not reported by Albuquerque)			
71-55-6	1,1,1-Trichloroethane (Methyl Chloroform)	not detected	u	u	u	not detected	u	u	u	10	0.3	0.3	0.2
79-00-5	1,1,2-Trichloroethane (Vinyl Trichloride)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
79-01-6	Trichloroethene (TCE)	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
95-63-6	1,2,4-Trimethylbenzene	5	0.3	0.2	0.1	7	1.1	0.3	0.1	(not reported by Albuquerque)			
108-67-8	1,3,5-Trimethylbenzene	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
75-01-4	Vinyl Chloride	not detected	u	u	u	not detected	u	u	u	(not reported by Albuquerque)			
108-38-3 & 106-42-3	m&p Xylenes	22	0.7	0.4	0.2	24	0.8	0.4	0.2	(not reported by Albuquerque)			
95-47-6	o-Xylene	8	0.3	0.2	0.1	8	0.3	0.2	0.1	9	0.4	0.2	0.1
	Total Xylenes	31	1.0	0.5	0.0	30	1.1	0.5	0.1	12	1.5	0.6	0.1
50-00-0	Formaldehyde	25	5.0	2.4	1.1	24	4.4	2.1	1.1	* 19	0.007	0.004	0.001
75-07-0	Acetaldehyde	25	3.5	1.4	0.7	25	2.2	1.1	0.4	* 19	0.003	0.001	0.001
67-64-1	Acetone	25	11.0	3.9	1.8	25	4.0	2.2	1.0	(not reported by Albuquerque)			

'u' Means that the substance was not detected.
It might be present between zero and the minimum detection level for that substance, but any such concentration would necessarily be very low.

* only 19 Carbonyl samples were taken

NMED Canister, Carbonyl, and Particulate Data (Sets 5, 6, & 7)

This canister data was presented and evaluated in the NMED report on Canister Samples. NMED conducted canister, carbonyl and particulate matter ambient monitoring at various times within the study area between December 26, 2002 and August 9, 2003. By coincidence, samples were collected in December 2002 and January 2003 during days when the Intel facility was in a "cool down" period of maintenance. Except for the appearance of 2-Propanol (Isopropyl Alcohol) when Intel was in normal operation and the disappearance 2-Propanol when Intel was not in normal operation, the analytical results were similar.

In an attempt to quantify concentrations due to any air toxics concentration "spikes" that might occur within the study area, residents of the area collected short-term canister samples when they experienced unusual odors or adverse health impacts. Residents were furnished evacuated 1-liter silonite canisters and instructed on how to take samples when they observed odors or experienced adverse health symptoms that might be associated with the inhalation of air toxins. Without a restricting orifice in the sampler, canisters filled within 15 seconds, eliminating the uncertainty of sample averaging over an extended time period. Area residents collected nine 15-second samples between Jun. 26 and Aug. 9, 2003. The analysis of these samples did not reveal any elevated concentrations of air toxics that the method could identify. Analytical results indicated some variability between canisters (mostly tentatively identified compounds or TICs), but their appearance was inconsistent and concentrations of specific identifiable air toxics were relatively low. Of all the detected chemicals, acetaldehyde was present in greater amounts in many of the samples, but not significantly.

NMED collected five 1-hour canister samples simultaneously with OP-FTIR measurements collected between August 6 and August 30, 2003. The analytical results from these samples could theoretically allow correlation and comparison with the OP-FTIR. The analysis was inconclusive as the two methods measure different compounds. During the simultaneous periods, the OP-FTIR identified water-soluble compounds (Ammonia, Methanol, etc.) and low molecular weight compounds (Carbon Monoxide, Methane) that are not detectable by the canister monitoring methods. The 1-hour canisters identified some compounds that that were detectable by the OP-FTIR, but at levels below the minimum detection limit (MDL) of the OP-FTIR. Toluene was identified in one canister sample, but the OP-FTIR did not measure toluene within its path until several hours later and at a higher concentration than the canister sample analysis.

Prism/Intel Ambient Air Sampling (set 3)

Intel collected community air samples between September 27, 2002 and March 20, 2003 at eight locations around the Intel facility fenceline. Paired samples, one upwind and one downwind, were taken on seven days. This data was submitted to the task force and NMED for use in the health risk assessment.

Samples were concentrated by drawing ambient air through carbon sorption tubes. The airflow rate of 10 liters per hour for 4 hours, produced a 40-liter sample with 4-hour

averaging time. The sample was thermally desorbed in the laboratory. Half was analyzed by gas chromatograph/mass spectrometer (GCMS) and half was analyzed by closed cell FTIR.

This monitoring method identified more air toxics than other monitoring methods, probably due to the large sample concentration, moderate averaging time, and the dual analytical method. The highest concentration measured was for isobutene (13 ppb), which was found in only one sample. Next highest was acetone, which was found in thirteen samples with a peak average of 5.1 ppb and an average concentration of 1.1 ppb. Most concentrations of most chemicals measured were less than 1 ppb. Nine different air toxics were detected within only one of the sampling periods.

OP-FTIR Results (sets 8 and 9)

NMED collected OP-FTIR data at two locations during August of 2003. Figure 2-1 is a map of the area with the monitoring sites depicted. Site A was near the most frequent source of complaints to the Air Quality Bureau, and was located 0.3 miles southeast of the Intel campus center. The other monitoring site was approximately 0.3 miles north-northwest of the center of the Intel campus. Site B was selected because an analysis of prevailing winds over the previous two years predicted that this location would be downwind of Intel most of the time during the month of August. Site B was also next to Highway 528.

Simultaneously, Intel collected OP-FTIR data at Site B initially while the NMED OP-FTIR was at Site A. On August 21, Intel moved their OP-FTIR from Site B. The Arcadis/NMED FTIR was moved to Site B on August 25. The Intel OP-FTIR moved to a third location, Site C, on August 21. Site C was on the Intel Campus approximately 0.2 miles from the center, and was closer to FAB-11x and the CUB building than sites A and B. In this manner, OP-FTIR measurements were being collected almost continuously near the Intel facility.

All NMED OP-FTIR data files were analyzed spectrally by Dr. Robert Kagann of Arcadis International, to confirm the identification and concentrations of specific air toxics. At the request of NMED, Dr Kagann also looked for air toxics of interest and in many cases stated that they were not present within the path of the OP-FTIR measurements. Four compounds were reported on a frequent basis: ammonia, methanol, tetrafluoromethane, and hexafluoroethane. Twenty-two additional compounds were detected on an occasional basis. Dr Kagann excluded ten chemicals as having never been present within the path (false positives), although the OP-FTIR software tentatively identified detectable concentrations of these compounds [for details, see the 2003 Monitoring Data Report, Tables 2a, 2b, and 2c].

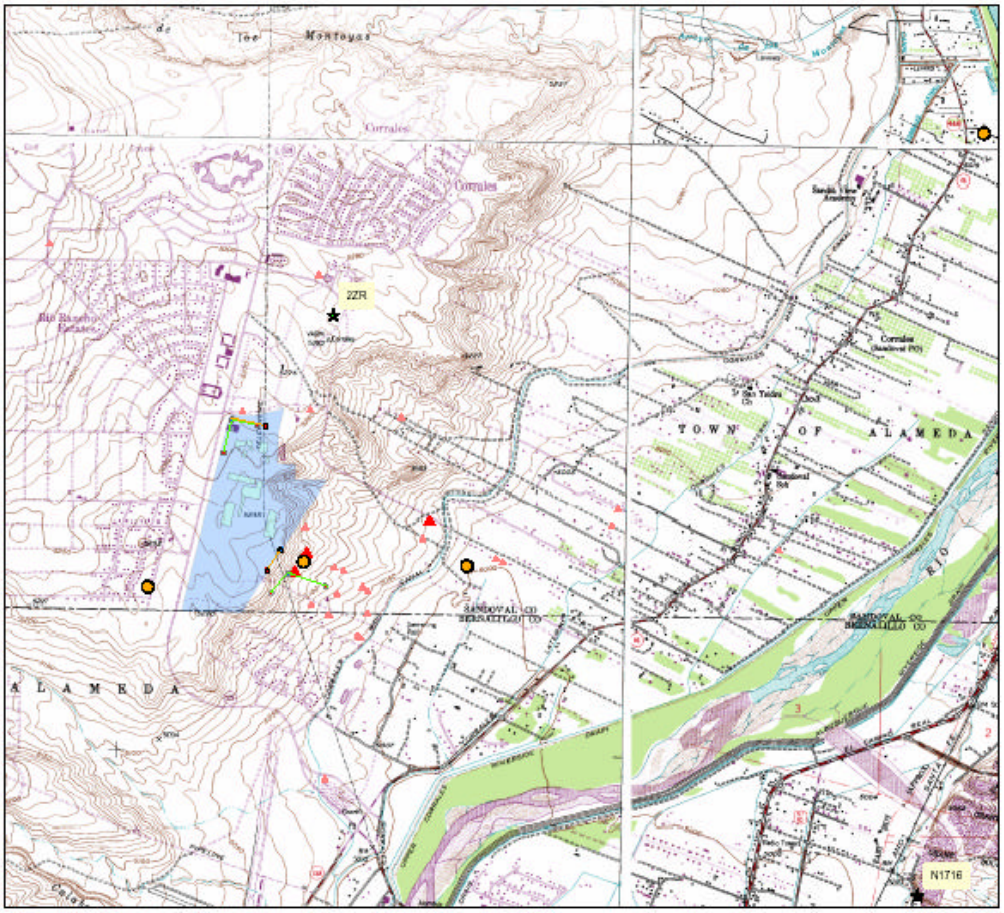
Intel OP-FTIR results were reported purely on the basis of software identification because spectral verification was not conducted. Due to the lack of spectral verification, these results are not sufficiently quality-assured. Subsequent third-party evaluation has determined that one lengthy indication of nitric acid was a false positive. Intel OP-FTIR data identified more compounds present in the paths measured than within the NMED

OP-FTIR paths. One possibility is that location C, used only by Intel was influenced by different sources of air toxics than locations A and B. Despite the uncertainties associated with the Intel OP-FTIR data, all Intel OP-FTIR data was used in the Health Risk Assessment, including the nitric acid false positive.

Intel Stack Monitoring During RTO Planned Maintenance (set 10)

Intel collected data at the request of NMED to establish worst-case stack exit gas concentrations in the event of planned maintenance (PM) or an unplanned control failure. NMED staff witnessed that the PM did in fact occur, and that uncontrolled exhaust gases were being sent up the RTO stack. This data cannot be evaluated in the same way as other data sets because data from Intel stack monitoring does not represent community exposure. Even when the RTO is not functioning, dispersion reduces exit concentrations over distance. NMED has examined the data and made comparisons to Arcadis/NMED FTIR data from Site A at the same time. One 1-hour canister was also available for comparison. A simple calculation revealed that over the distance from the RTO stack to location A, dispersion alone reduces concentrations by a factor of at least 1000; however, dispersion is not linear and this reduction factor cannot be used to quantify concentrations that might occur at or beyond the Intel fenceline due to a PM event. Subsequent tracer gas studies using known quantities of sulfur hexafluoride (SF6) yielded similar results.

Figure 2-1.
Map of Sampling Locations and Modeled Receptor Locations



Legend

Kilometers
0 0.3 0.6 1.2 1.8 2.4

Modeling Receptor Locations

- General Receptor
- High Value Receptor

NMED Permanent Air Monitoring Sites

VOC Canister Locations

INTEL FTIR Line of Site (path between instrument and mirror)

NMED FTIR Line of Site (path between instrument and mirror)

FTIR / Mirror Locations

N
W E
S

Intel buildings

Intel fenceline

Citizens Reports

Citizen's reports were collected from April 6, 2003 through May 5, 2004. A report form was created in conjunction with the task force. These forms were made available at Task Force meetings, Corrales Village Hall, Corrales library, Rio Rancho City Hall, the Rio Rancho Library, and Senior Citizens Centers. The form could also be downloaded from the NMED Corrales website and a copy was distributed in the Corrales Newspaper. While the report form accounts for a majority of the database entries, all reporting methods were allowed, including hand-written notes, email, and phone calls.

To protect privacy, a number was assigned to each person who submitted a report and that number was used consistently if the same individual submitted subsequent reports. A total of 266 reports were received during this period, summarized in the tables below.

Table 3 Reports per Individual

Individual #	Number of Reports
1	87
2	9
3	18
4	56
5	2
6	5
7	1
8	1
9	34
10	1
11	4
12	1
13	3
14	2
15	1
16	1
17	1
18	3
19	2
20	1
21	1
22	1
23	5
24	16
25	2
26	8
	266

Two individuals submitted 54% of the total reports. Five individuals submitted 79% of the total reports.

Reported health symptoms were also counted. Because individuals reported more than one symptom at a time, the number of symptom reports adds up to more than the total number of reports.

Table 4 Reported Symptoms

Symptom	# Reports
no symptoms	91
eye: dry, itchy, burned, watered	68
headache (mild, moderate, strong)	64
throat (sore, irritated, tight)	53
sinus, nose, nasal, stuffy or mucous	33
nausea or nauseous or vomiting	26
chest (sore, tight) bronchial or breathing difficulty	28
dizziness or disorientation	11
arm, leg, or body weakness	10
cough	4
bone, joint, or muscle ache	4
intestinal, diarrhea, stomach ache	4
metallic taste in mouth	3
skin	2
thirsty	1

The symptom most frequently reported was "No Symptoms." This entry occurred when the report was of an odor, noise, or visible plume with no associated symptoms. The next strongest indicator was eye symptoms (dry, itchy, burning, or watery) and so forth.

Emissions Inventory

NMED contracted with Henderson and Associates to compile a detailed emissions inventory within the study area. The inventory methodology followed EPA guidelines. The area and mobile source emissions were established using EPA-approved surrogate methods based on population. Point source emissions were determined through NMED emission inventory or quarterly reports, where available. The Intel facility emission inventory was based on quarterly reports that are submitted to the NMED by Intel. These quarterly reports include a calculation of emissions using emissions factors and other programs. Stack test results are used to ensure the general accuracy of these calculations.

Modeling Analysis

NMED contracted with Dr. Darko Koracin and Dr. John Watson to complete a dispersion modeling analysis based upon the emissions inventory. Dr. Koracin and Dr. Watson were provided detailed terrain data, meteorological data from the area, emissions inventory data, and citizen complaints logged for 2001. The CALPUFF model and CALMET meteorological model were chosen for the analysis due to the complex terrain in the Corrales area and the complexity of the meteorology in the area. The CALMET

model creates gridded wind field data that accounts for channeling of flows. The analysis looked at the emissions of 28 air toxics that:

a) had been detected by the NMED OP-FTIR in August, 2003 (3 chemicals)
b) had been detected by NMED canisters, August 2003 (4 chemicals)
c) had been reported by Intel Stack emission tests (8 chemicals)
d) had not been detected and whose emissions from Intel are quantified by "sink equations" (3 chemicals)
e) are emitted by Intel, had not been detected by monitoring and are on the EPA HAPs list (1 chemical)
f) are emitted by Intel, had not been detected by monitoring and are on the New Mexico TAPs list (9 chemicals).

In selecting Intel HAPs and TAPs that had not been previously detected, NMED started with the compounds with the largest emission rates from the emission inventory and worked down to compounds with smaller emissions.

The modeling analysis predicts concentrations (at receptor points) that are lower than measured concentrations from monitoring data. This can be explained by several factors:

1) Resources were not available to include area and mobile source emissions in the modeling analysis, so only the Intel facility emissions were modeled. While area and mobile sources likely contribute to measured concentrations in the study area, they are not easily included in a modeling analysis. Additionally, these emissions are spread across a greater area and become less significant when modeled as such, to the point that area and mobile source contributions to modeled concentrations is likely to be less significant. It is expected that modeled concentrations would be less than measured concentrations due to the omission of these sources.

2) Intel emissions were calculated as a 1-hour average emission rate derived from a quarterly emissions report. The quarterly emissions may not represent actual hourly or maximum hourly emissions from the Intel facility.

3) Measurements of air toxics primarily occurred from December 2002-September 2003. Modeling was conducted for a period of July 2001-July 2002. Differences in emissions profiles of various emission sources within the area may have changed.

4) The highest OP-FTIR concentrations came from locations on Intel property that were not modeled as receptor points. One location was next to Hwy 528 where traffic emissions contributed, and the other was significantly closer to the FAB 11x RTO and the CUB.

<u>Modeling analysis limitations:</u>
Even the best models are approximations of the real world. Instantaneous emission rates are not available for input to the model and the model cannot calculate instantaneous concentrations. Intel emission rates are not available for individual stacks, but rather

emission rates furnished by Intel are for groups of emission points. This creates uncertainty in modeled inputs that makes the model results somewhat unreliable. Meteorological data is collected every 60 seconds but is reported in 15-minute increments. This further limits the model's ability to predict short-term concentrations or evaluate the effect of short-term weather anomalies on concentrations. Dr. Koracin expressed concern that the Sandia Mountain east of the river valley would have a significant effect on air movement and since meteorological data specific to that area was not available, there is uncertainty in the meteorological model outputs. The model doesn't account for atmospheric chemistry, including atmospheric residence time and chemical interaction of emitted air toxics. Some air toxics are chemically reactive and the model cannot predict what chemicals might form or degrade within the study area.

Health Risk Assessment

The Gradient Health Risk Assessment (HRA) used all of the numeric modeling and monitoring data provided by NMED (Table 1 of this document, sets 5-9) to evaluate chronic and acute health risks. The HRA followed EPA guidelines in selection of screening values.

Gradient evaluated seven acute risk scenarios, summarized in Gradient Table 5.8. In each case, Gradient used the maximum1-hour and/or 24-hour average that was recorded to calculate a hazard quotient (HQ) for that substance. No individual compounds created a HQ greater than one. Generally, if exposures for a given chemical are at or below the acute inhalation exposure level (i.e., HQ less than one), then that chemical is not considered to pose a significant risk of adverse health effects. This means that short-term air concentrations representative of worst-case exposures do not exceed acute inhalation exposure criteria.

To estimate the risks of acute health effects due to combined sub-threshold exposures to multiple chemicals, the HQ for individual chemicals was added to obtain an overall acute hazard index representing the combined exposure. USEPA recommends this additive approach as a conservative technique for addressing the potential consequences of simultaneous exposure to multiple chemicals because data are not currently available to determine if interactive effects (*i.e.*, synergism, antagonism) occur from the combined exposure to the chemicals of concern. Although USEPA specifies that only hazard quotients for chemicals that act on a similar target organ or system be added together, all hazard quotients were conservatively added. This is a health-protective approach, where the summed hazard index likely overestimates potential health impacts since it sums hazard quotients for different chemicals that are based on maximum concentrations that occurred at different times and different places. For the evaluated acute risk scenarios, only one summed hazard index exceeded unity. A summed hazard index of 1.7 was obtained for the acute risk scenario using maximum 1-hour average concentrations obtained from the TRC OP-FTIR monitoring event where the monitor was located in the NW corner of the Intel campus with a southerly sample path.

Gradient assessed the chronic health affects using modeling estimates only for annual average concentrations. Approved chronic toxicity factors were not available for 17 of the 27 modeled compounds, so the report appears to indicate that only 10 were analyzed. Gradient subsequently calculated the chronic risk for all 27 compounds, using Texas Effects Screening Levels (ESLs) where other screening values were not available. The chronic HI with this methodology remains less than one (0.047).

NMED followed the Gradient protocol to look at chronic risk using the 41 chemicals analyzed in Rio Rancho and Bernalillo during the 1-year Urban Toxic study. From 46 samples, the highest 24-hour concentration for each compound was presumed to continue for a full year. No individual compound exceeded a health quotient of one. The combined synergistic hazard index was 0.46 at Rio Rancho and 2.35 at Bernalillo.

The health risk assessment is limited by the small amount of fixed monitoring site data used to represent potential personal exposures; data are not available to describe the short-term exposures of each individual even during the limited monitoring events, let alone other time periods.

In conclusion, this risk assessment did not find evidence that any of the measured or modeled chemicals are associated with increased acute or chronic health risks. Gradient qualified this conclusion, however, by pointing out that there are uncertainties associated with the available monitoring and modeling data.